



IUPUI

**SCHOOL OF INFORMATICS  
AND COMPUTING**

DEPARTMENT OF HUMAN-CENTERED COMPUTING

Indiana University-Purdue University  
Indianapolis

**NEWM N539**

**Augmented Reality Application Design and Development**

**Summer 2018**

*Section No.:*

*Credit Hours:*3

*Day/Time:*

*Location:* IT 255, Informatics & Communications Technology Complex  
535 West Michigan Street, Indianapolis, IN 46202 [\[map\]](#)

*First Class:*

*Instructor:* Zebulun M. Wood, MS in Technology, Lecturer

*Office Hours:*

*Office:* IT 463, Informatics & Communications Technology Complex  
535 West Michigan Street, Indianapolis, IN 46202 [\[map\]](#)

*Phone:* 317-278-4140 (Office)

*Email:* [zwood@iupui.edu](mailto:zwood@iupui.edu)

*Website:* <http://www.indianauploaded.org> (personal affiliate)

*Prerequisites:* [NEWM N504 Advanced Interactive Design Applications](#)

**COURSE DESCRIPTION:**

This course covers the design and development of computer games and simulations for augmented and virtual reality. To supplement and simulate the physical world, students research methods for integrating 3D objects and animations into interactive mobile applications. They also propose new, disruptive applications in entertainment, education, and other industries.

**Required Texts:**

Readings will be distributed through Canvas and augmented by the student's literature review.

**Reference Texts:**

[Lanham, M.](#) (2017). [Augmented reality game development](#). Packt. ISBN-10: 1787122883

[Grubert, J.](#) (2013). [Augmented reality for android application development](#). Packt. ISBN-10: 1782168559

**Supplementary Text:**

Author: Digital Tutors/Gnomon, 12-month membership, \$70

**Equipment needed:**

- Notebook
- Box Account [\[http://www.box.iu.edu/\]](http://www.box.iu.edu/)

**Software used:**

Autodesk Maya 2014 or Higher  
 Zbrush 4r6 or higher  
 Unity / Unity Pro 5 (to author)

**Course Objectives**

From their own design concepts, students create, test, and evaluate interactive experiences that augment mobile technology. Their concepts are critiqued and executed based on appropriate production flows while researching and documenting methods that define their respective approach. The planning, execution, and criticism of projects from peers engenders a high level of proficiency in evaluating, creating, and critiquing the development of augmented reality experiences and the costs associated with them.

**Learning Outcomes**

Upon completion of this course, students will

	<b>RBT</b>	<b>PGPL</b>	<b>Assessment</b>
1. Model and animate 3D computer-generated objects, from preproduction to production to postproduction.	6	1	Assignments
2. Apply the entire production pipeline for the application of 3D media in augmented and virtual reality interfaces.	3	1	Milestone 1 and 2
3. Design and implement an interactive computer game, simulation, or tool to display and manipulate objects or data in 3D.	6	2	Final Project
4. Conduct a literature review and develop an annotated bibliography in preparation for the final project.	5	2	Paper
5. Propose novel, disruptive applications of augmented and virtual reality based on a review of the current research.	6	2	Assignments Presentation

RBT: Revised Bloom's Taxonomy; PGPL: Principles of Graduate and Professional learning

**EXPECTATIONS, GUIDELINES, AND POLICIES****Attendance:**

For success in this class students are expected to attend each class session. Missed classes are only allowed if notice is given a full week in advance. This class has a stringent attendance policy of 1 dropped letter grade for each 2 classes missed. The instructor will take attendance at the beginning of each class.

**Incomplete:**

The instructor may assign an Incomplete (I) grade only if at least 75% of the required coursework has been completed at passing quality and holding you to previously established time limits would result in unjust hardship to you. All unfinished work must be completed by the date set by the instructor. Left unchanged, an Incomplete automatically becomes an F after one year. <http://registrar.iupui.edu/incomp.html>

**Deliverables:**

You are responsible for completing each deliverable (e.g., assignment, quiz) by its deadline and submitting it by the specified method. Deadlines are outlined in the syllabus or in supplementary documents accessible through Canvas. Should you miss a class, you are still responsible for completing the deliverable and for finding out what was covered in class, including any new or modified deliverable. In fairness to the instructor and to students who completed their work on time, no grade will be given on a deliverable, if it is submitted late. The material will still be reviewed and/or critiqued.

**Exams/quizzes:**

There are no exams or quizzes

**Lab assignments:**

Class tutorials and demos must be completed along with the instructor. Failure to do so can result in a detrimental effect on overall quality of work and trend in lower scores.

**Class assignments:**

Class assignments and projects must be finished and handed in on time. If you can't get in an assignment in before class, email it to me, upload it, and message it via Canvas.

As graduate students, you are expected to achieve exemplary results in all assignments, to lead in-class critiques, and to assist others. The assignments that you are asked to do amplify the whole class.

Final projects will not be accepted late.

**Grading Information:**

- Projects, papers, and class participation determine grades weekly
- Professionalism is graded over the entirety of the course and includes participation (in-class critiques and questions, on-time deliverables, presentation quality)
- Grades will be returned along with critique no later than two days after the assignment was turned in.

**WEEKLY SCHEDULE**

Week 1:

*Introduction:* Syllabus, Student & Instructor Introductions,  
Student Knowledge Inventory

*Lecture:* Equipment/Software Introduction  
Go over Resources, discuss current market

*Lab:* Go ideas student wants to do, and hardware they are working with at home

**Assignment:** Research and ideate field AR can enhance, discuss prototype project; conduct literature review and create annotated bibliography

Week 2 Tuesday:

*Lecture:* Introduce AR in action

*Lab:* Review interfaces of Both Maya and AR, do another full pipeline demo

*Assignment:* Work on art assets and code to develop simple AR interaction

Week 2 Thursday:

*Lecture:*

*Lab:* Finish AR implementation

*Assignment:* Prove you know pipeline with a full unity build in class

**Week 3 Tuesday: Field Trip possibility**

**Milestone 1:** Literature review and annotated bibliography paper. Pitch final project ideas(s), one business proof of concept and one entertainment proof of concept

**Week 3 Thursday: Field Trip possibility**

**Milestone 1:** Pitch final project Ideas(s), one business proof of concept + one entertainment proof of concept

**Week 4a Tuesday: Review pitches**

*Lecture:* Using textures and lighting in AR

**Assignment:** Deliver updates on projects

**Week 4b Thursday**

*Lecture:* Using Rigs and Animation in AR

*Lab:* Work in Class

*Assignment:* Deliver updates on projects

**Week 5a Tuesday**

*Lecture:* Developing AR Interaction, buttons, animations, audio, etc.

*Lab:* Work in Class

*Assignment:* Deliver updates on projects

**Week 5b Thursday**

*Lecture:* Developing AR Interaction, buttons, animations, audio, etc.

*Lab:* Work in Class

**Milestone 2:** Deliver updates presentation on projects

**Week 6a Tuesday**

*Lecture:* Review interactions and media implementations

*Lab:* Work in Class

*Assignment:* Deliver final updates on projects

**Week 6b Thursday**

*Lecture:* Last minute demos

*Lab:* Authoring for Mobile Devices

*Assignment:* finish and prep model for presentation

**Week 7:** Present Final Apps and interactions on devices

**Grading Information:**

**Weekly Assignments**

All assignments are to be delivered in a folder with your name, class , and week titled, if the assignment is Maya based ; with zipped Maya project folders, and will be evaluated through Oncourse within the week.

Each weekly assignment is *worth 50 points*.

Weekly assignments will consist of testing your prototypes of your application at various stages, with various groups, and reporting your findings both in presentation and written reports.

**Milestones**

Milestones are key points in the course in which students will be asked to generate their own technical solutions, present research and methods to one another as well as critique and analyze each other's methods from work over weeks.

- **Milestone 1** is a preliminary check on pipeline and understanding of using 3D design principles, and integrating assets in Unity. *Worth 100 pts*
  - This project is very dependent on your evaluation, planning, and execution of techniques in and outside of class to create an Augmented Reality App that is easy to use and understand. Productions often are thrown hurdles and delays; you will be responsible for hitting deadline and planning for these moments, while presenting your methods.
- **Milestone 2** is a secondary check on pipeline and understanding of using 3D design principles, user testing, reporting, integrating assets in Unity, and publishing your app to device. *Worth 100 pts*
  - This project is very dependent on your evaluation, planning, and execution of techniques in and outside of class to create an Augmented Reality App that is easy to use and understand.

Productions often are thrown hurdles and delays; you will be responsible for hitting deadline and planning for these moments, while presenting your methods, research on user testing your app, and plans to refine your experience.

**Final Project Milestone**

This is your final, in APP, this can be a highly detailed single object, an object or objects the user can interact and learn from, or something completely new

- 100 points towards asset level detail, quality, and efficiency
- 100 degree of difficulty, sell-ability of project
- 100 points for display of final product

### Tentative Assignments

	<i>Due Date</i>	<i>Assignment</i>	<i>Points</i>
Assignment 1	Week 2a	Bring in Models that you have already	50
Assignment 2	Week 2b	Deliver research and proposal for final project	50
Assignment 3	Week 3a	Deliver Method for testing and completing interaction, include what you will research	50
<b>Milestone 1</b>	Week 3b	Proof of Concept	100
Assignment 5	Week 4a	Finalize geometry	50
Assignment 6	Week 4b	Unwrap Geometry	50
Assignment 7	Week 5a	Finalize Rig or other assets, Test interactions and development in Unity	50
<b>Milestone 2</b>	Week 5b	Prep rig for animation or motion capture data, Test interactions and development in Unity	100
Assignment 8	Week 6a	Test interactions and development in Unity	50
Assignment 9	Week 6b	Export/Implement all assets and animations to test interactions and development in Unity	50
<b>Final Presentation of Project &amp; Research</b>	Week 7	Delivery of final product/ files	300
<b>Total</b>			<b>900</b>

**Grading Scale:**

A+	97 – 100	Outstanding achievement, given at the instructor's discretion
A	93 – 100	Excellent achievement
A–	90 – 092.99	Very good performance and quality of work
B+	87 – 089.99	Good performance and quality of work
B	83 – 086.99	Modestly acceptable performance and quality of work
B–	80 – 082.99	Marginal acceptable performance and quality of work
C+	77 – 079.99	Unacceptable work (Core course must be repeated for credit)
C	73 – 076.99	Unacceptable work (Core course must be repeated for credit)
C–	70 – 072.99	Unacceptable work (Course must be repeated for credit)
D+	67 – 069.99	Unacceptable work (Course must be repeated for credit)
D	63 – 066.99	Unacceptable work (Course must be repeated for credit)
D–	60 – 062.99	Unacceptable work (Course must be repeated for credit)
F	Below 60	Unacceptable work (Course must be repeated for credit)

No credits toward major, minor, or certificate requirements are granted for a grade below B–.

**CODE OF CONDUCT**

All students should aspire to the highest standards of academic integrity. Using another student's work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to the Department Chair and repeated violations shall result in dismissal from the program.

All students are responsible for reading, understanding, and applying the *Code of Student Rights, Responsibilities and Conduct* and in particular the section on academic misconduct. Refer to *The Code > Responsibilities > Academic Misconduct* at <http://www.indiana.edu/~code/>. All students must also successfully complete the Indiana University Department of Education "How to Recognize Plagiarism" Tutorial and Test. <https://www.indiana.edu/~istd> You must document the difference between your writing and that of others. Use quotation marks in addition to a citation, page number, and reference whenever writing someone else's words (e.g., following the *Publication Manual of the American Psychological Association*). To detect plagiarism instructors apply a range of methods, including Turnitin.com. <http://www.ulib.iupui.edu/libinfo/turnitin>

**Academic Misconduct:**

1. **Cheating:** <sup>SEP</sup>Cheating is considered to be an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment.
  - a. A student must not use external assistance on any "in-class" or "take-home" examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not



limited to, the use of tutors, books, notes, calculators, computers, and wireless communication devices.

- b. A student must not use another person as a substitute in the taking of an examination or quiz, nor allow other persons to conduct research or to prepare work, without advanced authorization from the instructor to whom the work is being submitted.
  - c. A student must not use materials from a commercial term paper company, files of papers prepared by other persons, or submit documents found on the Internet.
  - d. A student must not collaborate with other persons on a particular project and submit a copy of a written report that is represented explicitly or implicitly as the student's individual work.
  - e. A student must not use any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.
  - f. A student must not steal examinations or other course materials, including but not limited to, physical copies and photographic or electronic images.
  - g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor or program to whom the work is being submitted.
  - h. A student must not, without authorization, alter a grade or score in any way, nor alter answers on a returned exam or assignment for credit.
2. **Fabrication:** A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information.
  3. **Plagiarism:** Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered "common knowledge" may differ from course to course.
    - a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
    - b. A student must give credit to the originality of others and acknowledge indebtedness whenever:
      1. directly quoting another person's actual words, whether oral or written;
      2. using another person's ideas, opinions, or theories;

3. paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
  4. borrowing facts, statistics, or illustrative material; or
  5. offering materials assembled or collected by others in the form of projects or collections without acknowledgment
4. **Interference:**<sup>[[SEP]]</sup>A student must not steal, change, destroy, or impede another student's work, nor should the student unjustly attempt, through a bribe, a promise of favors or threats, to affect any student's grade or the evaluation of academic performance. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.
  5. **Violation of Course Rules:**<sup>[[SEP]]</sup>A student must not violate course rules established by a department, the course syllabus, verbal or written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course.
  6. **Facilitating Academic Dishonesty:**<sup>[[SEP]]</sup>A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct, nor allow another student to use his or her work or resources to commit an act of misconduct.

#### OTHER POLICIES

1. **Administrative withdrawal:** Students must participate in all class discussions and conscientiously complete all required course activities and/or assignments. If a student is unable to attend, participate in, or complete an assignment on time, the student must inform the instructor. If a student misses more than half of the required activities within the first 25% of the course without contacting the instructor, the student may be administratively withdrawn from this course. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal occurs after the full refund period, and a student who has been administratively withdrawn is ineligible for a tuition refund.
2. **Civility:** To maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, group work, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as ringing cell phones, engagement in private conversations, and other unrelated activities. Cell phones, media players, or any noisy devices should be turned off during a class. Texting, web surfing, and posting to social media are generally not permitted. Laptop use may be permitted if it is used for taking notes or conducting class activities. Students should check with the instructor about permissible devices in class. IUPUI nurtures and promotes "a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and

valued” (IUPUI Strategic Initiative 9). IUPUI prohibits “discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or veteran status” (Office of Equal Opportunity). Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.

3. **Communication:** For classroom-based courses, the instructor or teaching assistant should respond to emails by the end of the next class or, for online courses, within two Indiana University working days, which excludes weekends and holidays. The instructor should provide weekly office hours or accept appointments for face-to-face, telephone, or teleconferenced meetings, and announce periods of extended absence in advance.
4. **Counseling and Psychological Services (CAPS):** Students seeking counseling or other psychological services should contact the CAPS office at 274-2548 or [capsindy@iupui.edu](mailto:capsindy@iupui.edu). For more information visit <http://life.iupui.edu/caps/>.
5. **Course evaluations:** Course evaluations provide vital information for improving the quality of courses and programs. Students are urged to complete one course and instructor evaluation for each section in which they are enrolled at the School of Informatics and Computing with the following exceptions: (a) The student has withdrawn from the course; (b) fewer than five students are enrolled in the section (in which case maintaining anonymity is difficult); and (c) the section is a laboratory that must be taken with a course having a different section number. Course evaluations are completed at <https://soic.iupui.edu/app/course-eval/>. Course evaluations are typically open from the eleventh week. Course evaluations are anonymous, which means that no one can view the name of the student completing the evaluation. In addition, no one can view the evaluation itself until after the instructor has submitted the final grades. In small sections, demographic information should be left blank, if it could be used to identify the student.
6. **Disabilities policy:** All qualified students enrolled in this course are entitled to reasonable accommodations for a disability. Notify the instructor during the first week of class of accommodations needed. Students requiring accommodations register with Adaptive Educational Services (AES) and complete the appropriate AES-issued before receiving accommodations. The AES office is located at UC 100, Taylor Hall (Email: [aes@iupui.edu](mailto:aes@iupui.edu), Tel. 317 274-3241). For more information visit <http://aes.iupui.edu>.
7. **Email:** Indiana University uses your IU email account as an official means of communication, and students should check it daily. Although you may have your IU email forwarded to an outside email account, please email faculty and staff from your IU email account.
8. **Emergency preparedness:** Know what to do in an emergency so that you can protect yourself and others. For more information, visit the emergency

management website at <http://protect.iu.edu/emergency>.

9. **IUPUI course policies:** A number of campus policies governing IUPUI courses may be found at the following link: [http://registrar.iupui.edu/course\\_policies.html](http://registrar.iupui.edu/course_policies.html)
10. **No class attendance without enrollment.** Only those who are officially enrolled in this course may attend class unless enrolled as an auditor or making up an Incomplete by prior arrangement with the instructor. This policy does not apply to those assisting a student with a documented disability, serving in an instructional role, or administrative personnel. <http://registrar.iupui.edu/official-enrollment-class-attendance.html> Children may *not* attend class with their parents, guardians, or childcare providers.
11. **Religious holidays:** Students seeking accommodation for religious observances must submit a request form to the course instructor by the end of the second week of the semester. For information visit <http://registrar.iupui.edu/religious.html>.
12. **Right to revise:** The instructor reserves the right to make changes to this syllabus as necessary and, in such an event, will notify students of the changes immediately.
13. **Sexual misconduct:** IU does not tolerate sexual harassment or violence. For more information and resources, visit <http://stopsexualviolence.iu.edu/>.
14. **Student advocate:** The Student Advocate assists students with personal, financial, and academic issues. The Student Advocate is in the Campus Center, Suite 350, and may also be contacted at 317 274-4431 or [studvoc@iupui.edu](mailto:studvoc@iupui.edu). For more information visit <http://studentaffairs.iupui.edu/advocate>.

### MISSION STATEMENT

The Mission of IUPUI is to provide for its constituents excellence in

- Teaching and Learning;
- Research, Scholarship, and Creative Activity; and
- Civic Engagement.

With each of these core activities characterized by

- Collaboration within and across disciplines and with the community;
- A commitment to ensuring diversity; and
- Pursuit of best practices.

IUPUI's mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University's Strategic Directions Charter.

### STATEMENT OF VALUES

IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana's capital city and is

committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.